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Maine Agricultural Experiment Station

BULLETIN No. 148.

NOVEMBER, 1907.

INSECT NOTES FOR 1907.

This bulletin contains notes upon orchard insects; grass hoppers; beetles; a forest attack by one of "The Prominents"; Aroostook potato insects; and brief notes upon the other chief insects of the year.

Requests for bulletins should be addressed to the

AGRICULTURAL EXPERIMENT STATION,

Orono, Maine.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

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Fig. 34. The Carolina locust, killed by fungus, *Entomophthora grylli*. The specimen figured was collected at Orono, September 5, 1907. See page 270.

INSECT NOTES FOR 1907.

EDITH M. PATCH.

The annual bulletin published under the title of Insect Notes is a record of such insects of Maine as come particularly to the notice of the Station during the season. It is not designed primarily as a remedial measure bulletin, as advice of this character is sent largely to suit the individual needs either by personal correspondence or wherever possible by popular economic circulars which are kept constantly in print for this purpose. For notice of the species recorded in Insect Notes we are in a great measure indebted to people all over the State who send specimens for identification which are frequently of much interest. Although the Station would be glad to keep in touch with the insect life in every part of the State, its entomological work is often concentrated for an entire season in a few places and thus for information concerning local outbreaks we are dependent many times upon data volunteered by correspondents. To those people who have thus aided the Station for the current year, the present bulletin is in itself an acknowledgment.

Where definite lines of work are in progress, notes upon insects outside these definite lines must be more or less incidental and the most significant of these are brought together annually in a bulletin of miscellaneous Insect Notes.

THE GIPSY AND BROWN-TAIL MOTHS.

The two insects most to be dreaded in the State, the brown-tail and the gipsy moths, are discussed so fully in so much easily available and widely distributed literature* that they are merely mentioned here by way of constantly keeping the danger from them in mind. The success with which they have been so far combated in places in which they have been most numerous in this State should in no wise serve as an excuse for less vigilance, but rather as a stimulus to the continuation of the most rigid measures. Any temporary negligence with either

* Maine Agr. Exp. Sta. Circulars and Bulletins; Maine Dept. of Agriculture, Augusta, Circulars and Bulletins; U. S. Bureau of Entomology, Washington, D. C., Circulars and Bulletins.

of these insects will inevitably bring disaster with the necessity of combating them over ever increasing areas at enormous expense.

FORESTS ATTACKED BY ONE OF "THE PROMINENTS."

Heterocampa guttivitta Walk.

For a distance of more than 40 miles across Southern Oxford, Cumberland and Androscoggin Counties, a caterpillar invasion swept clear of foliage much of the forest growth over large areas. The complaints were numerous about the middle of August. A correspondent from Wayne wrote: "These caterpillars are on all the maples in this section and stripping the foliage." From West Bridgton another said: "They are ruining the hard wood growth in the forests of Fryeburg, Sweden, and of a part of Bridgton." A resident of Bridgton reported them as "very plentiful here and devastating certain sections of the forests. They seem to prefer the beech trees, though they also are found on maple and apple trees." Specimens accompanying all these and various other reports all proved to be the same species, *Heterocampa guttivitta*.

August 15 and 16, South Leeds and Upper Gloucester were visited by the writer. At Upper Gloucester a beech forest was stripped as bare of foliage as winter trees. The insects for the most part were full grown and buried for pupation. By lifting back the top of the leafy soil from 1 to 3 inches the freshly formed pupæ and newly buried larvæ were found to be thick. The cocoon was very slight and was torn in disturbing the soil.

Numbers of Carabid beetles were searching about the bases of trees, most conspicuous among which, probably, because of its size, was the Fiery Hunter, *Colosoma calidum*. The predaceous bug, *Podisus modestus* (shown in Fig. 44) was particularly active. This species in both larval and adult stages was found in considerable numbers on the trunks of the trees sucking the blood of wilted looking caterpillars which they had stabbed. At the bases of many of the trees were little heaps of dead and half sucked caterpillars, while the group of *Podisus modestus* just above and still at work on other victims showed the cause of their condition. At South Leeds these caterpillars had entirely stripped a beautiful hard maple grove and were at work rid-

dling adjacent beeches. The larvæ here were not quite full fed and the sound of their jaws together with that of falling bits of leaves and castings was like the sound of a rain storm. They were also at work on oak and apple at South Leeds but not to such an extent as on the maple and beech.

The larva resembles closely *H. manteo* and *H. bilineata* and the species was not definitely determined from this form. By keeping the pupæ moist and warm in the laboratory, however, adults began to emerge Dec. 3, 1907, and these were kindly determined by Doctor H. G. Dyar as *H. guttivitta* Walk.

The specimens taken in Maine this season presented the greatest variety of dorsal color patterns in white, green, and brownish purple. All the color variations faded in the full fed larvæ, however, and before pupating the body of the caterpillar was dull green with almost all trace of other color obliterated except the dark side lines of the head. Three specimens are shown in Figs. 39, 40, 41.

The weather in the southern part of the State, unlike the rest of Maine was very dry this season and seemed to be particularly favorable for caterpillar growth. Numerous other species were at work during August and the "green striped maple caterpillar," *Dryocampa rubicunda*, defoliated maples in certain localities. See Fig. 38.

FOREST TENT CATERPILLAR.

The Forest Tent Caterpillar, *Clisiocampa disstria*, has been in the increase in the State for 2 seasons, especially in the vicinity of Blaine and Mapleton, and though it is not yet very generally troublesome, it seems to be getting ready for one of its periodical outbreaks. A circular of information is in preparation for this species in order that the danger may be appreciated in localities where this caterpillar is gaining ground. The devastations of the forest tent caterpillar of 1889 and 1890* are plainly remembered by people living along the Penobscot and in the vicinity of Seboeis, who still refer to "the caterpillar year."

* Me. Agr. Exp. Sta. Report 1889, p. 188; 1890, p. 138.

ORCHARD TENT CATERPILLAR.

The large percentage of dead eggs of the common orchard tent caterpillar, *C. americana*, was noticed this season by even casual observers. This species was exceedingly numerous during 1906 and in certain Orono orchards as many as 5 to 20 egg clusters to a tree were found in the spring.

Following is the hatching record of 24 egg masses collected in April before any eggs had hatched:

Egg mass No.	Eggs Hatching.	Egg mass No.	Eggs Hatching.	Egg mass No.	Eggs Hatching.
1	0	9	0	17	41
2	0	10	0	18	138
3	0	11	92	19	4
4	0	12	93	20	96
5	0	13	0	21	108
6	0	14	64	22	0
7	0	15	123	23	5
8	0	16	26	24	134

This gives a total of 927 caterpillars to 24 egg masses, a number which would ordinarily be equaled by 4 or 5 egg masses.

The peculiar weather of the past winter may perhaps be held accountable for a share in this condition, not so much because of the excessive cold but because of the sudden changes occurring. On Jan. 16 the temperature swung from a maximum of 21 degrees above zero to a minimum of 40 degrees below zero the following night, making a range of 61 degrees in less than 24 hours. Jan. 21 the temperature ranged from 47 degrees above zero to 13 degrees below. It seems probable that a winter unusually long and severe with sudden fluctuations in temperature would be perilous for insect eggs exposed upon the twigs of trees as are those of the tent caterpillar.

CHERRY-TREE TORTRIX, *Archips (Cacæcia) cerasivorana*.

The "ugly nests" filled with little yellowish, black-headed caterpillars have been very numerous for several seasons, on wild cherry for the most part, though sometimes on apple and raspberry. One colony just hatching from the eggs was collected at Portland June 20 on chokecherry. These were reared in the insectary on apple leaves. The moths which developed from this colony had mostly emerged by August 6. A colony

just hatched on wild cherry at Orono June 12 was likewise bred on apple leaves and the moths emerged August 5-12. As is often the case with an insect which has for several seasons been particularly numerous, the cherry-tree tortrix has been this season attacked by various insect parasites.

Of the hymenopterous parasites, *Pimpla conquisitor* was taken at the ugly nest of this tortrix at Portland, July 23. *Exochus albifrons* Cr. were reared from ugly nests received from Otisfield, Maine. *Labronchus** sp. were reared from ugly nests from Otisfield, Waldoboro and Orono. *Macrocentrus** sp. were reared from nests from Waldoboro and Orono. A dipterous parasite, *Dichatoneura leucoptera* Johnson, emerged in great numbers from ugly nests from various localities.

One of the solitary wasps, *Odynerus* sp., was observed on the nest of this tortrix at Kennebunkport July 24. It had captured a full grown larva and with its jaws grasping the caterpillar just back of the head, was preparing to take flight. The larva was limp and helpless.

Archips feroxidana Clem., the oak ugly nest, was reported this year as last from Mt. Desert Island. September 8 a correspondent from Southwest Harbor stated that from one to several of these nests were in every oak and that the caterpillars were denuding the oak groves rapidly. Some of the same species of hymenopterous parasites which were present with *A. cerasivorana* emerged from Mt. Desert nests of *feroxidana*. *Dichatoneura leucoptera* Johnson and one other dipterous parasite were also bred from *feroxidana*.

ORCHARD INSECTS IN MAINE.

There is probably no reason so far as insects are concerned why apple raising should not be as profitably carried on in Maine as in other parts of the country. The conditions are, however, in many places far more promising at present for the production of insects than apples. Almost unbroken lines of neglected and therefore dangerous apple trees stretch for miles along the roadsides, scattering ungathered windfalls as

* For the determination of these two hymenopters as well as about 20 other insects appearing in this bulletin, which were not named in the Station collection we are indebted to specialists in the United States Bureau of Entomology, through the courtesy of Doctor Howard.

food for apple maggots, curculio grubs, and larvæ of codling moths. There is rarely a farmyard in which a few apple trees have not been planted and then in many cases left undisturbed as food for whatever insects chance that way. Wild cherries and hawthorn as well as native apples are permitted to grow within insect flight of cultivated apples and form entirely satisfactory breeding places from the standpoint of orchard pests. Paramount inducements are thus offered for every apple pest that can endure the climate. In the face of this cordial standing invitation to apple insects, there is many an orchard owner in the State who is grumbling because the invitation is annually accepted, and who has about decided that there is not much use trying to get perfect apples enough for his own family use.

There is a panacea for most of this trouble to be found in *clean culture*, by which is understood in part the clearing out of worthless trees, both cultivated and native, that serve as breeding places for orchard pests; the proper pruning and spraying of all apple trees not cut down; the tilling of orchard soil to disturb insects hibernating or transforming there; and the persistent destruction of windfalls.

The difficulties in the way of securing clean culture are not so serious for the man who depends upon his orchard for his income, for he would, of course, expect to supply himself with the necessary help and equipment. But the people who are engaged in other occupations and have only a small orchard, or a few favorite trees, cannot always conveniently give their trees the necessary attention. There is probably no neighborhood nor any grange in the State, however, which could not find one capable man who could be induced to care for the trees in a certain locality. The utterly hopeless conditions which small orchards present all through the southern part of the State would seem to offer a perfectly practical proposition for cooperation. Any grange or neighborhood could easily afford the spraying equipment.

The great economy of time and energy made possible by some such arrangement is apparent, for it would necessitate but one person making an effort to become acquainted with the dangerous insects, their vulnerable points and remedial measures instead of 20 or 30 to do so.

The number of insects which occur upon any one species of tree is likely to be excessive. The number of determined spe-

cies of oak insects, for instance, recorded by Packard* is over 400 for the United States, and he estimates that "it is not improbable that ultimately the number of species of oak insects for the United States will be between 600 and 800 or even 1000," when they are all determined. Yet oaks still grow! And even if there should prove to be 1000 species of insects which occur upon the apple, apples could probably still be grown and with care still be grown for profit as well as pleasure. But as a matter of fact the insects which are doing real damage to apple orchards in Maine at present are very well known so far as their life histories and remedial measures are concerned and there is not one among them that is not practically combatable if fought consistently over a considerable area. This could be done by each man taking care of his own trees, or much simpler by some system of cooperation by which one man could direct the care of trees on a given locality. It does not come within the intention of this bulletin to recommend the manner of such cooperation. It might be accomplished in various ways—through the grange, by a neighborhood club, or if the sentiment of the town supported such a movement, local measures could be secured against any neglected apple tree as a public nuisance and a danger to the orchards in the vicinity.

In view of the fact that the apple crop is one of the chief interests of the State, the Maine Agricultural Experiment Station has constantly had the orchard in mind with reference to insects of economic importance. The majority of inquiries which are received accompany insects found upon apple trees. In order that fuller information may be sent in reply to such inquiries than could be possible through a personal letter, illustrated circulars upon about 30 orchard insects most common in the State are kept in print for use in correspondence, and are sent as replies to persons submitting these insects for identification.

With this economic literature available for distribution to anyone in the State at any time, it hardly seems necessary to repeat annually extended bulletin notes upon such standard orchard pests as the red humped caterpillar, the yellow-necked caterpillar, the tiger caterpillars (*Halisidota caryæ* and *H. macu-*

* Forest Insects, page 48.

lata), the fall web worm, the tussock caterpillar, the tent caterpillar, the bud moth, the codling moth, the apple maggot, and others, unless some such unusual condition arises as a peculiar parasite invasion or an unwonted increase which should, of course, be noted.

While the available circulars include only a small number of the multitude of apple insects, yet if the orchards are so treated as to combat the serious pests, the multitude of lesser evils need not be feared, for they will for the most part succumb incidentally to the treatment given to the really dangerous insects and thus many species may be killed with one treatment. Moreover the remedial measures against the standard pests overlap. For instance, the destruction of windfalls by pasturing an orchard with hogs is a measure directed at once against 3 of the worst apple insects in the State—the apple maggot, the curculio and the codling moth. Or removing colonies while young and still gregarious includes the red humped caterpillar, the yellow-necked caterpillar, the tiger caterpillar and others, all of which occur upon the trees during the same time. In a similar way, because arsenical sprays are recommended for a multitude of orchard pests, it does not mean that the sprays need be applied a multitude of times each season.

Much study has been put upon these orchard pests by economic entomologists all over the country, but that avails the orchards nothing unless the orchardists make practical use of the resulting suggestions. Experiment Stations have repeatedly demonstrated the value of spraying for the codling moth, yet it is optional with the owner of the trees whether he shall profit by those demonstrations or not. It has been known for 18 years that a consistent and persistent destruction of infested fruit would practically exterminate the apple maggot, and the apple maggot is working in many parts of Maine as much havoc now as it did 20 years ago.

It is due orchardists of the State that the insect pests upon so important a crop should be studied for the purpose of finding what can be done by way of combating them. It is no less due orchardists of the State that careless owners of neglected trees should somehow be induced to contribute to the health of orchards in general by either caring for their own trees or cutting them down.

If the well known and constantly recommended remedial measures against orchard insects of Maine were to be applied in good earnest, the standard apple insect pests of Maine would diminish in a wholesale and satisfactory degree. And this is a matter that rests with the owners of trees. Merely by way of comment it might be stated that in certain localities where it has been known for 15 years or more that the apple maggot (or "railroad worm") must be fought by the destruction of infested fruit, it is not unusual to hear some such remark as "Now, there's that high top sweeting. I haven't had an apple to eat from that tree for five years. The railroad worm gets them all." And while season after season the infested fruit is permitted to lie and rot undisturbed upon untilled sod beneath the tree, the railroad worm is actually blamed for continuing to breed in conditions rendered ideal for that very purpose. The full humor of the situation is forthcoming when the owner of the high top sweeting complains of his neighbor for rearing curculios in his apples "to infest all the apples in the vicinity," though just what difference it makes whether the railroad worm or the curculio gets the fruit is not apparent. However, merely by way of interesting information the neighbor's attention is called to Fig. 35, which presents a curculioed apple. If raisers of such deformed fruit would pasture their orchards with hogs they would destroy the curculios which are a menace to the neighborhood and incidentally some of the descendants of the railroad worms which have migrated from the high top sweeting across the way.

GRASSHOPPERS.

The summer of 1907 has been conspicuously a grasshopper season. Many species were more abundant than usual, but the red-legged locust, *Melanoplus femur-rubrum*, was, so far as observed, guilty of most of the serious trouble. They were present over a large part of the State all summer in troublesome numbers, but most of the complaints were made in August after the grass was harvested, when they were to be started up in clouds. Potato fields, large orchards, raspberry and blueberry bushes, as well as a great variety of other vegetation suffered. The "Carolina locust," *Dissosteira carolina*, was very common, but this species together with many other of the grass-

hoppers fell victims to the fungus *Entomophthora grylli*,* during late August and September.

Figure 34 shows one of these grasshoppers in the position characteristic of victims of the grasshopper fungus. In low meadows the work of this same fungus was particularly to be observed with certain of the *Tryxalinæ*, as many as 4 or 5 dead grasshoppers being found clinging to a single grass stem. One of the invariable symptoms of this disease is evinced in a tendency to climb and to cling, and the dead grasshoppers remain clinging to the tops of grass heads or weeds until beaten off by storms. The sick grasshoppers when disturbed do not jump but instead climb a little higher and clasp their legs a little tighter about the plant they are on.

Except in the southern part of the State, the season was very wet, a condition which favored fungus parasitism among much of the insect life, hairy caterpillars and plant lice as well as grasshoppers being especially susceptible.

BEETLES.

Buprestids.—Chief among the Buprestids of the season is *Brachys ærosa* Melsh. June 15, 1907, everywhere in the vicinity of Portland the adults of this species were common, feeding greedily upon the leaves of various trees. Collections were made from *Alnus incana*, oak, hazelnut, wild rose, elm, hawthorn, birch, cherry, *Amelanchier*, hazelnut and willow, the leaves of all of which they were skeletonizing, though they were most abundant upon the first four mentioned. As many as 12 to 20 of these beetles were common upon a single leaf of alder or oak. Their bright metallic colors made them conspicuous in the sun. At the slightest jar they relaxed their hold and slipped to the ground. They were not taken in large numbers in other parts of the State, though a few were found at Orono and elsewhere during June. This species in the larval stage is a leaf miner.

The strawberry weevil, *Anthonomus signatus*, is apparently widely distributed throughout the State, although strawberry growers have not complained of their presence to any great extent on cultivated plants. One large strawberry crop a few miles out from Farmington was practically destroyed by this

* Kindly determined by Doctor Roland Thaxter.

weevil this season, however. The weevils were collected in considerable numbers also near Houlton, June 28, 1907, about the blossom buds of wild red raspberry. Some of the weevils were inside the buds depositing eggs and others were observed to be nibbling at the bud stem, causing the buds to wither, as is their custom.

The Rose Chafer, *Macrodactylus subspinosus*, continued to be as troublesome this year as last. From Clinton it was reported as destroying hens. Another correspondent sent specimens of this beetle with the statement that out of a flock of about 2000 chickens on free range nearly 400 had killed themselves in 5 days by stuffing themselves with these chafers. The birds averaged from 12 to 13 weeks, and in some cases part of the chafers with which their crops were packed were still alive after the death of the greedy chicken.

The Striped Cucumber Beetles, *Diabrotica vittata*, were so numerous this season at Orono that cucumber and squash vines suffered severe attacks. Lime, bug death, sulphur, red lead, or ashes heaped thick upon the plants kept the beetles from the upper surface of the leaves, but as they congregated cheerfully underneath and ate through the leaves to the application on the upper side, these remedies did not avail much. Turpentine or kerosene and land plaster when applied about the plants in sufficient amount to keep away the beetles, killed the plants. This may have been partly due to the fact that a heavy rain followed the treatment and beat the young plants down against the application. One man practically rid his field by going over his vines when they were very small and gathering and killing the beetles by hand. The beetles were so thick that thousands were readily killed in this way. After gathering the beetles for 3 consecutive mornings, the infestation was reduced to such an encouraging extent that the process was repeated 3 or 4 mornings more, when no further treatment was necessary. This was, of course, a tedious method, but it disposed of the beetles inside of a week, while a field a few miles distant where nearly all the remedies which have ever been recommended against this pest were tried on different plats, the beetles remained in extremely troublesome numbers for between 3 and 4 weeks, during which time the adults had deposited so many eggs that some of the vines wilted later in the season

from the larval attacks in the stalks. In these treated plats the fall generation appeared in October as numerous as in June and the Hubbard squashes were pitted thickly with holes in which the beetles feasted until the squashes, which were undersized anyway, were unpresentable for market purposes.

Macrops vitticollis.—Besides the flea beetles, *Dibolia borealis* Chev., which riddled the plaintain leaves, *Plantago major*, all over the State, plaintain crowns were found to be excavated by numerous small beetle larvæ. Some of these were collected July 23 at Portland in order to secure the adult beetles. On August 26, 2 beetles developed which proved to be *Macrops vitticollis* Kirby.

SAWFLIES.

The birch sawfly, *Nematus erichsonii*, is again at work in Maine upon the larch or tamarack, or as it is more popularly known here, the "juniper." By August 8 the work was mostly in the vicinity of Houlton, but clusters of larvæ still remained here and there and it was gratifying to note that a fair percentage of these had attached to them the small white eggs of a *Tachina* parasite. The larvæ of *Cræsus latitarsus*, a sawfly common in the State, were received from Bar Harbor September 17, where they were attacking birch. The fir tree sawfly, *Lophyrus abietis* Harris, was present at Seeket, where it completely stripped some fir trees and spruce. Cocoons were received from this locality August 29 and September 10, and on the latter date cocoons of the same species were received from MacMahan, Sagadahoc County. The adults emerged from the middle to the last of September. This species also attacks the pitch pine, and seems to have a deplorable start in the localities mentioned.

AN ANT ATTACK ON PLANT LICE.

June 12, a birch growth was visited where great numbers of a large and sprightly aphid, *Callipterus betulæcolens*, were to be found both in late pupal and freshly winged condition. This species is very active, running lightly and dropping from the branch at the slightest jar, and were thus seen everywhere on the ground as well as on the trunks of evergreens and other trees where they do not feed.

Ants were observed to be traveling to their nests with these aphids in their jaws, both in the late pupal and the winged

stage. As numerous ants were doing this and from many nests, the incident was of particular interest. As the aphids appeared to be squeezed and helpless, all the ants which could be caught in about 20 minutes were made to drop their aphids for examination. The aphid in each case was either dead or roughly injured and there seemed to be but one explanation—that the ants were appropriating these juicy insects for food. In view of the peaceful and often interbeneficial relations of ants and aphids in general this occurrence seems worth noting.

AROOSTOOK POTATO INSECTS.

The nearly continuous rains of the season made field observations unprofitable in this part of the State. A considerable mass of miscellaneous data for various potato feeding insects has accumulated, but the notes for the most part should be supplemented by observations over a longer period of years, before being recorded. A single species of plant louse, *Nectarophora solanifolii*, was followed closely throughout the season and the results given in a separate bulletin. A spring search for the tarnished plant-bug, *Lygus pratensis*, present in enormous numbers last fall,* was made May 6-8, with the surprising outcome that in a particularly favorable hibernating place only one tarnished plant-bug was uncovered in several hours' careful hunting. Meanwhile 200 or 300 ground-beetles and rove-beetles were observed skirmishing the same haunts, and the following laboratory feeding experiments confirmed the suspicion that the tarnished plant-bugs seeking this shelter the previous fall, crept literally into the jaws of their natural enemies.

Predaceous Beetles and Hibernating Insects.—Feeding notes for ground-beetles and rove-beetles. A potato field near Houlton, the vines of which were in the fall of 1906 overrun with tarnished plant-bugs, 2 species of flea beetles (*E. cucumeris* and *S. hudsonias*) as well as other plant feeding insects, is bordered by tempting shelter for hibernating insects. At the left of this field separating it from the next is a lane with a line of logs laid in lieu of a fence. Grass and weeds grow the whole distance and more or less rubbish (piles of old potato vines, etc.)

* Me. Agr. Exp. Sta. Bul. 134, p. 214-215.

have been tossed up along the ridge. At the right of the field is an uncultivated piece of land, part swamp and part wooded knolls, along the slopes of which the fallen leaves are caught in drifts. Search was made in the spring, May 6-8, before their hibernating pests were on the wing in this locality, and though tarnished plant-bugs were found in considerable numbers under the leaves at the right of the field where predaceous beetles were not present to any great extent, at the left, equally favorable hibernating ground to all appearances, these insects were found in the proportion of 1 to several hundred ground-beetles and rove-beetles. The inference was acted upon by collecting the beetles for laboratory observations as to their diet. The ground-beetles were the common Carabid species, *Pterostichus lucublandus* Say.

Test with a lot of 22 ground-beetles.

May 11. They were given one *Cosmopepla carnifex* which they did not eat until May 18.

May 13. They were given 2 negro bugs (*Corimelana pulicaria*). These they devoured May 15.

May 14. They were given 6 sowbugs. May 18 only one live sowbug was left and a beetle was carrying off bits of a sowbug.

They showed no eagerness in regard to any of the foregoing insects. May 18, however, they became much excited upon being given an inch-long moth pupa. They tried patiently to bite it, but the pupal skin was particularly hard and it slipped about so that it had to be finally cut for them. In less than a minute 20 of the 22 beetles were either feeding upon the pupa or fighting violently for a chance. They hauled one another off by the legs and were very much excited and vicious, the taste of this food seeming to make them tigerish. They had been stupid for a week previous. While they were still excited over the one-inch pupa they were offered a cecropia pupa taken uninjured from the cocoon. This they attacked at the abdominal creases and succeeded in biting through. After gorging at this feast the beetle abdomens protruded beyond the wing covers for more than one-sixteenth of an inch, giving them a peculiar appearance.

Test with Lot of 8 ground-beetles.

May 13. They were given 8 negro bugs (*Corimelana pulicaria*) and one *Cosmopepla carnifex*. May 18, 3 negro bugs and the *C. carnifex* had been eaten. A crushed live negro bug offered them was devoured at once. They showed hesitation in attacking live ones. Their jaws seemed to find little purchase when they tried. Four beetles were observed to bite at the same negro bug, but their jaws slipped off every time without harm to the bug.

May 18. A sowbug which had been with them for 5 days was still alive and unharmed.

May 18. They were given an unbroken cecropia pupa, which they soon punctured at the abdominal rings and gorged as much as their bodies would hold.

Test with lot 23 ground-beetles.

May 10. They ate on this date 3 cut worms (a little less than 1 inch long), 2 tarnished plant-bugs and 1 wounded sowbug.

May 11-12. They devoured 5 unwounded sowbugs and 1 *Cosmopepla carnifex*.

May 13. They disposed of the half of a beetle *Serica vespertina* that was cut for them.

May 15. They were offered small eggs but remained indifferent to those that were broken for them as well as the whole ones.

These ground-beetles seem a little shy about attacking their prey, but when the first pair of jaws have pierced the chitinous skin the other beetles gather about and there is soon nothing left of the soft parts of the victim. If a morsel is small enough a beetle grabs it and runs, often with several beetles after him. At the body of an insect too large to be dragged much they pile up one above another devouring the prey, or if others crowd them away they bite viciously at one another for a place. They nip at one another between the thorax and abdomen or pinch each others' legs. One beetle had one of his legs bitten off between the femur and tibia by another who was trying to drag him away from a cutworm.

Test with the rove-beetles or Staphylinids.

These beetles ate tarnished plant-bugs, negro bugs (*C. pulicaria*), *Cosmopepla carnifex* and cutworms. Three Staphy-

linids ate a fourth of the same species which was enclosed in the same vial with them. They had no other food at the time. Two individuals were observed pulling at 1 small cutworm like 2 chickens over an earthworm, each bracing its legs and tugging while they curved up the tips of their abdomens high in the air with a threatening jerk. A small cutworm was given to a pair of hungry rove-beetles. The female dragged the partly devoured caterpillar beneath her and bit the male so viciously when he attempted to share it that he died about an hour later.

All the insects fed to the Staphylinids as well as the Carabids were alive and uninjured except when otherwise stated.

The fate of countless hordes of hibernating insects must be settled by such predaceous beetles during the fall and spring, and thus such lively and difficult insects to combat as the tarnished plant-bug find a natural check in the voracious appetites of these beetles everywhere to be seen skirmishing over the ground and under rubbish. The common ground-beetles would seem effective particularly with such soft-bodied insects as the tarnished plant-bug which proved attractive morsels during the feeding observations. This pest is particularly active only in the warmth and sunny weather, and seeks shelter during weather which the ground-beetles accept for hunting days. Its dormant days particularly during the fall and spring are a vulnerable season in the life history of the tarnished plant-bug at a time when the ground-beetles are still active. Such natural aids as these are, it is to be regretted, often entirely unappreciated, yet they accomplish more in a case like the tarnished plant-bug which is often not practically combatable by artificial means than man could possibly hope to do.

Cosmopepla carnifex.—July 19 about 20 of these little black and red bugs which are numerous upon potato, mullein, mint, thistle, buttercups and many other plants near Houlton were caged upon a potato plant in the insectary. August 13, one bug and several young ones were still feeding upon the plant, the stalks and leaf stems of which showed numerous black beak wounds.

Euchistus tristigma.—From June 13 to July 4, 10 of these large bugs were caged on a potato plant in the insectary. During this time several egg clusters were deposited upon the leaves

of the plant and upon the cage. The young, hatching, took at once to the potato and fed there and the old bugs spent much time with their beaks deep in the stalks drinking sap. The beak punctures caused little swollen lumps to appear about the black wound on the stalk and along the midvein of the leaves. See Figs. 36 and 37.

Podisus modestus.—A second and larger insectary colony of the foregoing bugs, *E. tristigma*, was observed to be rapidly diminishing in numbers. Examination showed that a specimen of the predaceous bug *P. modestus* had been inadvertently caged with them. This bug was placed in a glass with 8 young *E. tristigma* and was observed to stab and suck them dry. *P. modestus* is an old and well-known enemy to dangerous insects. It was observed this summer feeding upon larvæ of the potato beetle, currant worms, tent caterpillars, cabbage worms and other caterpillar pests. See Fig. 44.

Milo, July 5, the writer found a female of this species depositing eggs on balsam fir. Two neat rows of eggs were started on the underside of a needle when the bug was found, 6 eggs having been deposited, the first at the tip of the needle. The bug was suspended dorsum down with all 6 legs clasped about a single needle, the abdomen tip pointed toward the tip of the needle. The next 5 eggs were laid regularly and alternately left and right and one egg was deposited after every 2 minutes' wait, at 2.09, 2.11, 2.13, 2.15, 2.17 P. M. exactly. The bug then left the needle and the 11 eggs.

Grasshoppers were at Foxcroft and other localities thick enough to injure potato vines, particularly along the edges of the fields, the common red-legged locust, *Melanoplus femurrubrum*, doing most of the damage.

Blister Beetles.—From Columbia Falls, August 11 a box of beetles came with the complaint that they were "very destructive on the potatoes, many times as bad as potato bugs." These were the gray blister beetles, *Macrobasis unicolor*, Kirby, which are now and then numerous enough to be very troublesome locally. A black blister beetle, *Epicauta pennsylvanica*, also fond of potatoes, is on the increase in the southern part of the State. As the larvæ of blister beetles feed largely upon grasshopper eggs, their appearance in large numbers is almost certain to follow a grasshopper increase, and in reckoning their depre-

dations on potato and certain garden vegetables their benefits as a destroyer of grasshoppers must be taken into account. An oil beetle, *Meloe angusticollis*, closely related to the blister beetles, was found here and there eating potato leaves, but these are not numerous enough to do any damage.

Trichocera regelationis Linné.—Maggots breeding in potatoes. May 17, in response to complaints of maggoty potatoes, a visit to Patten was made in order to examine the infested potatoes. Great numbers of slender maggots were found in a lot of potatoes that froze last fall and were soft and rotting in May. Some of these potatoes were placed in the insectary and the adults which emerged about June 1 proved to be the species recorded. A second generation developed in the insectary, 16 adults appearing about October 26. Whether this species would develop in healthy potatoes was not ascertained.

GALL INSECTS.

No attempt has been made to list the insect galls of Maine. The following few species taken in this State are in the Station collection, together with the insects emerging from them. Such of these as had not previously been determined were submitted to Mr. William Beutenmuller, American Museum of Natural History, who kindly determined them:

Aphid galls.—*Pemphigus rhois*, Fitch, on sumach; *Pemphigus populimonilis*, on *Populus balsamifera*; *Hormaphis hamamelidis*, Fitch, on *Hamamelis virginiana*; *Hamamelistes spinosus*, Shiner, on *Hamamelis virginiana*; *Colopha ulmicola*, Fitch, on elm; *Chermes abietis*, Linn, on spruce.

Mite galls.—*Acarus serotinae*, on wild cherry; *Acarid*, on *Amelanchier*; *Phytoptus* (*Eriophyes*) *quadripes*, Shimer, on Norway maple.

Dipterous galls.—*Cecidomyia niveipila*, O. S., on oak; *Cecidomyia* sp., on hazel nut; *Cecidomyia* sp., on *Crataegus*; *Cecidomyia batatas*, O. S., on willow; *Cecidomyia strobiloides*, O. S., on willow; *Cecidomyia rigidæ*, O. S., on willow; *Cecidomyia solidaginis*, Loew., on golden rod.

Hymenopterous galls.—*Andricus palustris*, O. S.; *Andricus punctatus*, Bass., on oak; *Andricus* (*Callirhytis*) *scitula*, Bass., on oak twigs; *Andricus* sp., on red oak; *Andricus ventricosus*,

Bass., on oak; *Diastrophus turgidus*, Bass., on red raspberry; *Diastrophus cuscutæformis*, O. S., on blackberry; *Biorhiza forticornis*, Walsh., on *Quercus alba*; *Eurostra solidaginis*, Fitch., on golden rod; *Holcaspis globulus*, Fitch., on oak; *Rhodites globulus*, Beuten., on rose; *Rhodites bicolor*, Harr., on rose; *Rhodites rosæ*, Linn, on rose; *Rhodites radicum*, Bass., on sweet briar; *Solenozopheria vaccinii*, Ashm., on *Vaccinium canadense*; *Andricus lanata*, Gill., on red oak.

TABLE RECORDING SOME OF THE INSECT COLLECTIONS
OF 1907.

A considerable number of insects interesting either in themselves or deriving a significance due to the circumstances in which they are found, come to the attention of the Station each season. A few of these which it seems desirable to record without extended notice are listed in the table on the 3 succeeding pages.

Table recording some of the insect collections of the season of 1907.

Scientific name.	Common name.	Date.	Locality.	Remarks.
<i>Coleoptera.</i>				
<i>Admonia cavicollis</i> Lec.	Cherry leaf beetle	July 5	Milo.	Riddling leaves of wild cherry. Depositing eggs.
<i>Adoxus vitis</i> Fabr.		July 30	Sherman.	Feeding on leaves of <i>Salix</i> sp.
<i>Agrius ruficollis</i> Fab.	Red-necked blackberry borer.	July 11	Farmington.	Adults feeding on blackberry leaves.
<i>Amphicomma lupina</i> Lec.		July 29	Auburn.	Reported very numerous in Timothy meadow.
<i>Anthobium pokhos</i> Mannh.		July 6	Orono.	Numerous in blossoms of <i>Viburnum cassinoides</i> L.
<i>Brachyacantha ursina</i> Fab.		July 18	Orono.	Great numbers on cherry tree in orchard.
<i>Brachyacantha ursina</i> Fab.		July 5	Milo.	Common on brake fern. Mating.
<i>Callidium antennatum</i> Newm.	Black horned Callidium.	May 27	Athens.	Adults numerous in attic of new house.
<i>Callidium antennatum</i> var.	Black horned Callidium.	June 25	Orono.	Resting on cedar trunks.
<i>Clytanthus ruficollis</i> Oliv.		July 8	Orono.	Adult beetle feeding on rose buds.
<i>Crepidodera helix</i> es Linn.	Small willow flea beetle.	June 15	Portland.	Eating willow, wild cherry and apple leaves.
<i>Crioceraphus agrestis</i> Kirby.		July 14	Orono.	Adult beetle taken.
<i>Cryptoccephalus notatus</i> Fab.		June 28	Houlton.	Adults feeding on hazelnut and willow. Mating.
<i>Cryptorhynchus lapathi</i> Linn.	Willow borer.	June 7	Orono.	Single beetle on willow twig.
<i>Dibolia borealis</i> Chev.		June 18	Throughout the State	Leaves of plantain, Plantago major, everywhere riddled by this flea beetle.
<i>Dichelonychia elongata</i> Fabr.		June 26	Orono.	Feeding on leaves of alder, birch and plum.
<i>Dichelonychia testacea</i> Kirby.		June 26	Orono.	Feeding on leaves of alder, birch, and plum.
<i>Disonychia 5-vittata</i> Say.		July 11	Orono.	Common on willow. Mating and depositing eggs.
<i>Gymnetron teter</i> Fabr.		July 18	Sherman.	Numerous among buds of mullein, <i>Verbascum thapsus</i> L.
<i>Haltica carinata</i> Germ.		June 26	Orono.	Beetles numerous feeding on elm. Eggs yellow, in rows along midrib and other veins.
<i>Haltica ignita</i> Seliger.	Lesser grape vine flea-beetle.	June 18	Portland.	Common. Eating foliage of wild rose.
<i>Hoplia trifasciata</i> Say.		July 5	Milo.	Beetles numerous in flower clusters of <i>Viburnum cassinoides</i> L. Mating.
<i>Hylesinus aculeatus</i> Say.	Ash timber beetle.	Sept. 6	S. Waterford.	"In quantities on windows."
<i>Isomira quadristriata</i> Coup.		July 5	Milo.	Numerous in flower clusters of <i>Viburnum cassinoides</i> L.
<i>Lina lapponica</i> Linn.		June 28	Houlton.	Adult taken on <i>Populus</i> .
<i>Malachius aeneus</i> Linn.		June 28	Houlton.	Flying about buttercups and other meadow flowers
<i>Monohammus marmorator</i> Kirby	Marbled pine borer.	Aug. 12	Bar Harbor.	Single specimen taken.
<i>Pissodes dubius</i> Rand.		Orono.	Orono.	Common.
<i>Phyllobrotica limbata</i> Fabr.		July 11	Farmington.	Beetles riddling deadly night-shade. Numerous.

Polygraphus rufipennis Kirby	Destructive spruce bark beetle	June	28	Houlton	Near bridge over Meduxnekeag R. which was filled with logs.
Rhabdopterus pictipes Oliv		July	11	Farmington	Numerous on blackberry eating leaves. (They ate both potato and apple in confinement).
Rhagium lineatum Oliv	Ribbed pine borer.	June	12	Orono	Adults common.
Rhopalopus sanguinicollis Horn		June	25	Orono	Adults common.
Rhyncobites cyanellus Lec		July	30	Sherman	On Salix sp. Mating.
Saperda calcarata Say	Poplar borer.	Aug.	19	Orono	Single specimen taken.
Saperda moesta Lec	Poplar borer.	June	15	Veazie	23 adult beetles taken just before emerging from galls on twigs of single tree, Populus balsamifera
Scaphilus asperatus Bonsd		July	25	Farmington	Adult feeding on elder berry leaves, also taken in strawberry bed
Serica sericea Ill.	Silken Serica.	June	15	Orono	Numerous on alder and birch.
Trichius affinis Gory		July	15	Orono	Adults eating rose blossoms.
Trirhabda canadensis Kirby		July	24	Kennebunkport	Numerous, eating leaves of goldenrod.
<i>Lepidoptera.</i>					
Ceratomia amyntor Geyer	Horn shouldered sphinx.	Aug.		Various localities	Larvæ often reported from elm. Usually the green variety but sometimes the brown.
Eutichia ribearia Fitch	Curvant span worm.	July	16	Houlton	Larvæ on wild currant. Moths emerged July 31.
Euproctis chrysorrhæa Linn.	Brown tail moth	July	24	Kennebunkport.	Part of larvæ parasited.
Euproctis chrysorrhæa Linn.	Brown tail moth	Aug.	14	N. Haven	Moths numerous. Depositing eggs.
Euproctis chrysorrhæa Linn.	Brown tail moth	Sept.	4	W. Pownal	2 live female moths received with the eggs masses just deposited. Late specimens.
Hyperichia liliaria Harris	Lime tree winter moth.	June	23	Houlton	An egg mass received, not yet hatched. Very late.
Hyperichia lo Fabr	Lo moth			Various localities	Larvæ on apple and wild cherry.
Oxyptilus tenuidactylus Fitch	The raspberry plume	July	11	Farmington	Larvæ numerous on trees and in gardens. Several cases of painful poisoning reported.
Paonias excavatus S. & A.	Blind eyed sphinx	Sept.	10	Orono	Moths common resting on wild blackberry. Mating Larvæ covered with cocoons of Braconid parasites. On willow.
Paonias myops S. & A.		July	18	Houlton	A pair of moths.
Phloxoperis nubeculana Clem.	Apple leaf sewer.	Sept.	11	Clifton	Larvæ numerous in orchard.
Sesia tipuliformis Linn.	Curvant borer.	June	23	Orono	Moths collected from currant bushes. Mating.
Sphinx chersis Hbn.	Pen marked sphinx.			Various localities	Moths and larvæ very common.
Sphinx drupiferarum S. & A.				Various localities	Moths and larvæ very common. Many parasited by tachinids.
Sphinx gordius Cram.	Apple sphinx.	July	2	Exeter	Larvæ.
Tolype vellela Stoll	Velleda lappet			Various localities	Larvæ numerous during August on apple. Moths depositing eggs, Sept. 17-23.

Table recording some of the insect collections of the season of 1907—Concluded.

Scientific name.	Common name.	Date.	Locality.	Remarks.
<i>Diptera.</i>				
<i>Anopheles quadrimaculatus</i> Say.	.....	Sept. 9	Orono.....	Taken in house.
<i>Phorbia brassicæ</i> Bouché.....	Cabbage maggot.....	Apr. 30	Winthrop.....	Pupæ near roots of diseased lettuce in hot beds. Adults emerged May 13.
<i>Phorbia ceparum</i> Meigen.....	Onion maggot.....	June 29	Orono.....	In Onions. Adult flies emerged July 22.
<i>Rhagoletis pomonella</i> Walsh.....	Apple maggot.....	July 16	Orono.....	Flies common about apple trees.
<i>Rhagoletis pomonella</i> Walsh.....	Apple maggot.....	July 11-25	Farmington.....	Flies common about apple trees.
<i>Rhagoletis tabellaria</i> Fitch.....	.....	July 11-25	Orono.....	Flies numerous upon <i>Cornus stolonifera</i> Michx. Later, maggots of (probably) this species plentiful in the berries.
<i>Hymenoptera.</i>				
<i>Limneria guignardi</i>.....	.....	Sept. 14	.....	Parasites bred from red humped caterpillar, <i>Oede-</i>
<i>Urocerus abdominalis</i> Harris.....	Yellow banded Urocerus.....	Aug. 8	Houlton.....	<i>masis concinna</i> . Single specimen male.

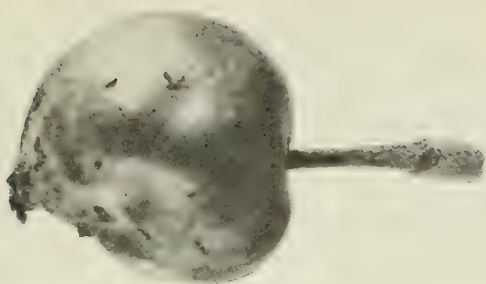


Fig. 35. Apple deformed by Plum curculio. The apple figured was taken from an orchard near Portland about the middle of July, 1907. See page 269.



Fig. 37.



Fig. 36. Eggs and recently hatched young of plant feeding bug. *Euchistus tristigma*, on potato leaf. Notice wound on stem which is caused by the full grown bug of same species shown in Fig. 37. Insectary material, Orono, 1907. See page 277.

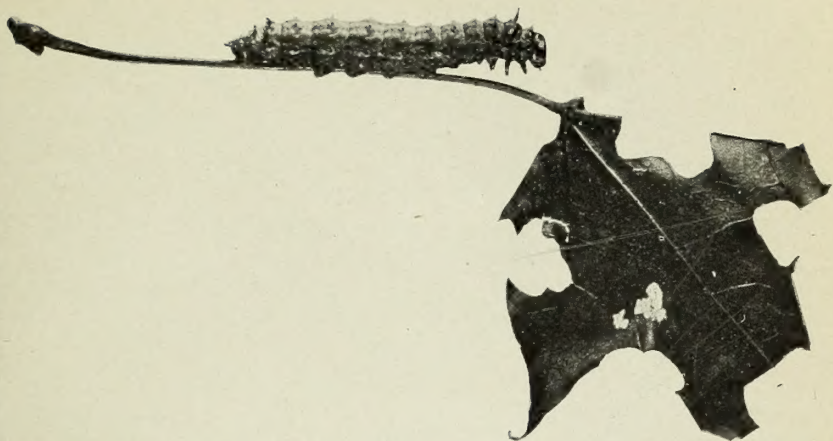


Fig. 38. Green striped maple caterpillar, *Dryocampa rubicunda*. Taken near Greene, Me., August 14, 1907. See page 263.



Fig. 39.



Fig. 40.



Fig. 41.



Fig. 42.



Fig. 43.

Figs. 39, 40, 41, three color varieties of "The Prominent" caterpillar which ravaged hardwood growths in Maine this season. Specimens collected at South Leeds August 15, 1907.

Figs. 42, 43. Pupæ of "The Prominent" taken at Upper Gloucester, August 17, 1907. See page 263.



Fig. 44. Predaceous bug, *Podisus modestus* (slightly enlarged), which feeds upon destructive caterpillars and other insects. See pages 262 and 277.

LIST OF AVAILABLE PUBLICATIONS ON COMMON ORCHARD INSECTS.

Those published by the U. S. Department of Agriculture will be sent on application to your Congressmen, or to the Secretary of Agriculture, Washington, D. C.

Those published by the Maine Department of Agriculture can be obtained from the Commissioner of Agriculture, Augusta, Maine.

And those published by the Station may be had on application to the Maine Agricultural Experiment Station, Orono, Maine.

Antique tussock moth Δ	Oyster shell bark scale Δ
Aphides affecting the apple +	Pear slug +
Apple maggott or Railroad worm Δ	Plum curculio +
Brown-tail moth Δ O X	Red-humped caterpillar Δ
Canker worm Δ	Rose chafer +
Cecropia moth Δ	Round headed borer +
Cherry tree tortrix Δ	San Jose scale +
Codling moth O	Sphinx moths Δ
Fall web worm Δ	Spotted tiger moth Δ
Flat headed borer +	Tent caterpillar Δ
Forest tent caterpillar Δ	Tiger swallow-tail butterfly Δ
Gypsy moth Δ O X	White marked tussock moth Δ
Hickory tiger moth Δ	Woolly aphid of the apple +
Io moth Δ	Yellow necked caterpillar Δ

Δ Me. Agr. Exp. Sta. Circ.

+ U. S. Dept. of Agric., Bureau of Entomology Circular.

O U. S. Dept. of Agric., Farmers' Bulletin.

X Maine Dept. of Agriculture, Augusta.